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Mineral Composition of Soil and Wild Desert Truffles in Saudi Arabia

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Abstract. Two hypogeous truffles and subsurface and surface soil samples were collected from Hafer Al-Batin area, North-Eastern region of Saudi Arabia. The truffles are identified as *Terfezia claveryi* and *Phaeangium lefebveri*. Laboratory study of the mineral composition of soil and identified truffles revealed the following: soil samples contained higher levels of calcium, copper, iron, potassium, magnesium, manganes, sodium lead and zinc than the tested truffles. The soil reaction in the vicinity of truffles ranged from the mildly alkaline (surface) to moderately alkaline (subsurface). Both organic matter and moisture contents are higher for the subsurface than for the surface samples.

Introduction

Terfezia claveryi Chatin and *Phaeangium lefebveri* Patouillard are two wild truffles (fungus) species of the order pezizales, dominating Saudi Arabia and Kuwait as well as other parts of the world [1, 2, 3]. Their morphological characters resemble those described elsewhere by Patouillard [4], Awameh and Al-lSheikh [5], Al-Sheik and Trappe [6] and Bokhary and Parvez [3]. They are generally eaten as delicious food and are popular among a wide sector of the local community. Both fungal spp. have potato like tuber appearing usually after the rainy season (February-March) each year. The edible tubers are energy rich carbohydrates believed to lend activity and vigor in various ways to consumers. T. claveryi has been reported to be useful in the treatment of some eye diseases [7]. Despite their economic importance, as a wildly growing and available energy sources, truffles have received little attention with respect to their mineral content in this part of the world. Therefore, study was to determine the metal content of the truffles and also to investigate metal level in the surface and subsurface soil.

Materials and Methods

Fruiting bodies of *T. claveryi, P. lefebveri* and soil samples from subsurface and surface of the tested truffles were collected from Hafer Al-Batin area, North-Eastern region of Saudi Arabia. In each case the soil samples were scraped (1-15 cm) into plastic bags using a stainless steel spoon. The samples were passed through a 2.0 mm sieve mesh and were digested in concentrated nitric acid to obtain a measure of total mineral content using the procedure described by Hashem [8]. In this procedure, 0.5 g of air dried soil were placed in a 100 ml beaker with 15 ml of concentrated nitric acid, covered with a watch-glass and heated at 95-100°C for min. The digest was made up to 50 ml with deionized water and analyzed for mineral content by atomic absorption flame spectrophotometer (pye Unicom sp° equipped with sp° computer). The fresh truffles were washed thoroughly and subjected to the extraction procedure described by Hashem and Al-Homaidan [9].

Soil moisture content, organic matter and pH value were determined according to the techniques devised by Boradbent [10] and Peech [11], respectively. Five replicates from each soil sample and truffle were anlyzed for mineral content.

Table 1. Soil characteristics of surface and subsurface

Truffle species	Moisture content %		Organic matter %		pH value (1:2.5 soil/water suspension)	
	Subsurface	Surface	Subsurface	Surface	Subsurface	Surface
T. claveryi	6.31	2.83	0.76	2.59	8.3	7.6
P. lefebveri	4.69	2.11	0.63	1.32	8.1	7.8

Table 2. Mineral content of subsurface and surface soil at the vicinity of the tested truffles

Mineral element	Mineral content of soil ((µg/g)			
	T. claveryi		*P. lefebveri*	
	Subsurface	Surface	Subsurface	Surface
Ca	3000±6.19	2690±5.11	3119≠7.13	2813±4.31
Cd	3.09±0.62	2.11±0.31	5.11±0.11	2.31±0.01
Cu	23.1±0.91	18.8±0.02	30±0.93	21±0.11
Fe	43.0±0.98	35.6±0.69	53±0.13	29±0.91
K	2314±4.86	2349±4.31	2500±5.11	2211±4.13
Mg	3530±6.83	3100±6.93	2890±5.36	2540±3.62
Mn	9.63±0.21	2.93±0.12	7.31±0.81	4.13±0.93
Na	2133±4.39	1813±4.13	2390±3.96	2113±0.29
Pb	7.36±0.12	4.13±0.31	10.32±0.13	6.72±0.29
Zn	15.0±0.69	13.6±0.81	22±0.31	16±0.93

n = 5 ± = standard deviation

Results and Discussion

The results of moisture content, organic matter and pH value (Table 1) are consistent with the previous findings in Saudi Arabian soils [8, 12, 13, 14, 15]. The soil reaciton values of the soil samples examined showed that the subsurface soil is moderately alkaline while the surface is mildly alkaline. The results of mineral content of the examined soils are presented in Table 2. Subsurface and surface soil samples differ slightly in their mineral composition. The estimated concentrations of Na, Mg, K, Ca, Cd, Cu, Fe, Mn, Pb and Zn recorded were found to be similar to the previous findings obtained for Saudi Arabian soils [8, 14, 15]. The data obtained for mineral composition in this study were lower than those reported by previous workers for soils elsewhere in the world [16, 17, 18]. Heavy metals like Cd, Cu, Mn and Zn present in natural soil environment serve as essential micronutrients for both microorganisms and plants [8, 19, 20]. However, heavy metals released by human activities may enrich the environment and become available at potentially toxic concentrations for organisms [21, pp. 133-145]. The results of mineral composition of the tested truffles are summarized in Table 3. Both truffles are similar in their mineral composition, but the content is lower than that of soil. These results are consistent with the findings of Hashem [14], and Hashem and Al-Homaidan [9].

Table 3. Mineral content of the examined truffles

Mineral element	Mineral element content of truffles (μg/g)	
	T. claveryi	*P. lefebveri*
Ca	172.31 ± 3.20	191.19 ± 3.16
Cd	0.76 ± 0.06	0.33 ± 0.01
Cu	14.31 ± 0.81	10.93 ± 0.98
Fe	12.87 ± 0.69	14.93 ± 0.84
K	156.11 ± 3.06	145.83 ± 3.11
Mg	85.31 ± 1.87	70.11 ± 2.07
Mn	1.87 ± 0.19	1.01 ± 0.09
Na	163.11 ± 3.96	143.32 ± 3.17
Pb	0.92 ± 0.06	0.81 ± 0.08
Zn	10.92 ± 0.88	9.33 ± 0.81

n = 5
± standard deviation

It is clear that the mineral concentrations obtained in the present study were lower than those reported by previous workers [22, 23, 24, 25]. Therefore, it is probable that consuming the examined truffles may not cause any health troubles. It is worth mentioning that this investigvation presents baseline data on the mineral content of desert truffles from Saudi Arabia.

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المحتوى المعدني للتربة ولبعض أنواع الكمأة في المملكة العربية السعودية

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(سُلِّم في ٢٢ رجب ١٤١٤هـ؛ وقُبل للنشر في ١٤ شعبان ١٤١٥هـ)

ملخص البحث. تمَّ جمع عيّنات من التربة تحت وفوق السطحية لبعض أنواع الكمأة من منطقة حفر الباطن في الشمال الشرقي للمملكة العربية السعودية. كما تمَّ أيضًا جمع الأجسام الفطرية لتلك الأنواع من الكمأة وقد تمَّ تعريفها علميًّا فوُجد أنّها:

ترفيزيا كلافاري وبوقينم لفباري. وقد تمَّ تحليل التربة والكمأة لمعرفة المحتوى المعدني، حيث أوضحت نتائج هذه الدراسة أن التربة تحتوي على نسبة عالية من عناصر الكالسيوم، الكادميوم، النحاس، الحديد، البوتاسيوم، المغنيسيوم، المنجنيز، الصوديوم، الرصاص والخارصين، بينما تقل نسبة تلك العناصر في الكمأة. وقد أوضحت نتائج هذه الدراسة أيضًا أنّ التربة تحتوي على نسبة قليلة من الرطوبة والمحتوى العضوي وأنّها قلوية.

تصلح الكمأة التي تمّت دراستها غذاءً للإنسان وأنّه لا توجد أضرار صحية منها لأن نسبة العناصر المعدنية السامة بها قليلة.

وقد تمّت مناقشة النتائج المتحصل عليها في هذه الدراسة فَوُجد أن المحتوى المعدني للتربة والكمأة يقل كثيرًا عن تلك المتحصل عليها من دراسات مختلفة في العالم.